

## Hydrologic modifications

Urbanization can have a large impact on the hydrology of a watershed as natural vegetation is replaced by impervious surfaces; streams and creeks are channelized (deepened and straightened) or ditched to improve drainage of adjacent lands; or dredged for navigation (North Carolina Sea Grant 1997), often resulting in increased runoff. Runoff from agriculture, urban/suburban development, and transportation infrastructure carries sediment, nutrient, and toxic chemical pollutants (DWQ 2000). Sediment, the number one pollutant of waterways in the United States, can clog shellfish gills or bury entire organisms (Coen et al. 1999). Excess nutrients can fuel algal blooms and low DO events, and in turn, cause mortality of benthic organisms on deep, subtidal shell bottom (Lenihan and Peterson 1998). Heavy metals, petroleum products, pesticides, and other toxic chemicals in the runoff can kill sensitive larvae (Wendt et al. 1990; Funderburk et al. 1991).

Channelized streams are often deeper, with more extreme flows. Channelization potentially affects bay scallops in several ways. By removing the meanders of the channel and increasing the slope of the shoreline, water velocities in the altered stream are higher, which can result in more rapid salinity fluctuations in the estuary, erosion of the shoreline, and increased sediment loading. In many channelized streams, storm flows are confined primarily to the main channel rather than passing through wetlands and achieving some filtration of pollutants, deposition of sediment, and water storage. In addition, the natural woody vegetation along the sides of the stream is often removed in the process of channelization. Consequently, loading and movement of sediment and other nonpoint source pollutants are often greater in channelized sections than natural streams, which can have negative impacts on water quality and therefore fish habitat (EPA 2001). Nutrient concentrations, particularly for nitrogen and phosphorus, may increase with channelization.

## Low oxygen

Adequate supply of DO is critical to survival of benthic invertebrates and fish. However low dissolved oxygen is generally not an issue in shallow, tidally flushed, high salinity estuarine waters where scallops commonly occur.

## Toxins

Because bay scallops are filter feeders, toxins can accumulate in scallop tissue and affect their growth and survival. While toxins can fluctuate between the sediment and water column, concentrations of toxic chemicals tend to accumulate in sediments at concentrations several orders of magnitude greater than in overlying waters (Kwon and Lee 2001). Toxic chemicals can become active in soft bottom sediment or overlying waters through several mechanisms, including resuspension from natural weather events or human activities, such as dredging and trawling.